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5. INSTRUMENT DATA FOR BIOLOGICAL SCIENCES AT HISTORICALLY BLACK COLLEGES AND UNIVERSITIES

5.1. Introduction

The previous chapter of this report covered the background and methodology for the HBCU survey and describes the results of the survey of biological science departments and facilities (units). This chapter presents findings for research instruments that were used for research in the biological sciences at HBCUs in 1993. It focuses upon three general sets of issues regarding research instruments in the biological sciences:

- **General Characteristics.** This first set of issues concerns the number of biological research instruments found at the HBCUs; their age; their patterns of use by researchers, faculty, and graduate students; and the extent to which they are used to conduct research in fields of science and engineering other than biology.

- **Financial Resources.** The second set of issues concerns the financial resources that have been used for these instruments. Of particular interest is the total monetary value of the aggregate stock of biological research instruments found at the HBCUs,[35] the sources of funds used to acquire these instruments, and the funds spent in 1993 to maintain and repair these instruments.

- **Evaluation.** Finally, the instrumentation survey collects evaluative data regarding these research instruments. The PIs were asked to evaluate the research status of their instruments (i.e., state-of-the-art, adequate, or inadequate); their general working condition; the extent to which their technical capabilities meet the needs of their users; and the adequacy of the maintenance and repair provided to these instruments.

5.1.1. Data Considerations

The procedures used to collect data for biological departments and facilities research instruments from the population of 44 HBCUs were the same as those used to collect data from the panel of 79 large research universities, with two exceptions. First, institutions, departments, and instruments were not sampled in the survey of HBCUs. Second, the minimum purchase price criterion used to select instruments for the HBCU survey was $10,000, whereas a minimum purchase price criterion of $20,000 was used for the panel survey of 79 large research institutions.

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[35] Data for the total monetary value, or total cost, of research instrumentation are for the total current stock of in-service research instruments in the biological sciences. These instruments may have been purchased in any year, not just in the reference year for the survey (e.g., 1993). Data for the purchase of research instruments that were presented in the previous section of this report, that presented unit-level data, refer only to instruments purchased during the reference year for the survey and not to the total stock of research instruments in biology.

5.2. Analytic Approach

In 1993, the HBCUs had 338 instruments costing $10,000 or more that were used to conduct research in the biological sciences. The total monetary value of these instruments was $8.6 million. For reporting purposes, each of these instruments has been categorized as one of five general types:

- **Computers and data handling equipment (Computers).** These instruments accounted for 6 percent of research instruments with a purchase price of at least $10,000. In terms of total value, they accounted for 7 percent of the total value of the inventory of research instruments in the biological sciences at the 44 HBCUs.

- **Chromatographs and spectrometers (Chromatographs).** This instrument type included elemental analyzers and spectrophotometers. It accounted for 22 percent of all research instruments. It also accounted for 16 percent of the total value of the inventory of research instruments.

- **Microscopy instruments (Microscopes).** Microscopes accounted for 20 percent of all research instruments in the biological sciences and 33 percent of the total value of research instruments.

- **Bioanalytical instruments (Bioanalytical).** This was the largest general type of instrument category in the biological sciences in terms of total instruments, 33 percent. It included cell sorters/counters/cytometers, centrifuges, and growth/environmental chambers. Its total monetary value was 29 percent of the value of all biological research instruments.

- **Other instruments.** This is a grouping of miscellaneous instruments not easily classified. The largest single type of "other" instruments in the biological sciences at the HBCUs was temperature/pressure control/measurement instruments. Also represented were lasers and optical instruments. This group accounted for 20 percent of all research instruments in the biological sciences and 14 percent of the total monetary value.

Like the HBCUs' department data, the instrument data are reported using three broad analytical categories: type of institutional control (private, public); type of institution (doctorate-granting, non-doctorate-granting); and a system price range ($10,000–$19,999, $20,000 or more). Of the 57 units, 22 were located in doctorate-granting institutions, and 35 in non-doctorate-granting institutions. There were 31 units in the public institutions, and 26 in the private institutions. Of the 31 units located in public institutions, 6 (19 percent) were located in doctorate-granting institutions. Of the 26 units in private institutions, 16 (62 percent) were located in doctorate-granting institutions.

In addition, this analysis will present findings for:

- **Type of institution.** Within the population of HBCUs presented in this report, there are two principal types of institution: doctorate-granting and non-doctorate-granting.[36] There are 11 doctorate-granting institutions and 33 non-doctorate-granting institutions.

- **Type of control.** Of the 44 HBCUs, 16 are private and 28 are public.

- **Instrument system price range.** Instruments have been sorted into two price ranges for analysis: $10,000 to $19,999, and $20,000 or more.

5.3. Characteristics of Research Instruments in the Biological Sciences

The purpose of this section is to present findings for four key issues regarding the aggregate stock of biological research instruments in the HBCUs during 1993: How many research instruments were there? How old were they? Who used them? To what extent were they used to conduct research in fields of science and engineering other than biology?

5.3.1. Sources of Data

Two sources of data were used to provide data regarding the general characteristics of the research instruments at the HBCUs. First, each participating institution was asked to provide an inventory of its research equipment, including each instrument's type, location, and date of purchase. From this information, the number of research instruments by type, field of science, price range, and age were determined. Second, the principal investigator (PI) for each instrument was asked to provide a headcount of the number of faculty, graduate students, postdoctorates, and other researchers who used the instrument during the survey's reference period, 1993. The PI also was asked to identify the principal field of science and engineering in which the instrument was used for research as well as all other secondary fields in which the instrument was used.

5.3.2. Number and Types of Instruments

In 1993, the 44 HBCUs had 338 research instruments costing more than $10,000 in their biological science units. Of these instruments, 112 (33 percent) were bioanalytical instruments. Chromatographs comprised the second largest number of research instruments, 75 (22 percent). (Table 31)

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[36] The population of 44 HBCUs included three medical schools. The medical schools did not contain a sufficient number of units or instruments to be analyzed separately.

Table 31. Number and percent of instrument systems in the biological sciences at historically black colleges and universities, by institutional control, type of institution, system price range, and major type of instrument: 1993

Institutional control, type of institution, and system price range	Major type of instrument											
	All instruments		Computers and data handling instruments		Chromatographs and spectrometers		Microscopy instruments		Bioanalytical instruments		Other instruments	
	Total	Percent	Total	Percent	Total	Percent	Total	Percent	Total	Percent	Total	Percent
Total, all systems	338	100%	20	100%	75	100%	66	100%	112	100%	66	100%
Institutional control:												
Public	161	48	4	22	42	56	40	61	40	36	35	53
Private	177	52	15	78	33	44	26	39	72	64	31	47
Type of institution:												
Doctorate-granting	156	46	13	68	33	43	16	25	57	51	36	55
Non-doctorate-granting	182	54	6	32	43	57	49	75	54	49	30	45
System price range:												
$10,000-$19,999	200	59	7	35	46	62	43	66	58	52	45	69
$20,000 or	138	41	13	65	29	38	23	34	53	48	21	31

NOTE: Because of rounding, details may not add to totals.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

The majority (59 percent) of instruments in the biological sciences in 1993 were in the $10,000–$19,999 price range. Sixty-nine percent of all "other" instruments were in this category, followed by 66 percent of microscopy instruments, and 62 percent of chromatographs. Computers were the only major type of instrument of which the majority (65 percent) cost more than $20,000. Also, 68 percent of computers were owned by doctorate-granting institutions. (Table 31)

5.3.3. Age of Research Instruments in the Biological Sciences

Fifty-one percent of the research instruments in the biological sciences at HBCUs were 8 years and older. Twenty-six percent of the research instruments were between 4–8 years of age, 24 percent were between 0–4 years of age, and only 9 percent were less than 2 years old. The mean age was 7.9 years. (Table 32)

Table 32. Current age of academic research instruments in the biological sciences at historically black colleges and universities, by source of funds, institutional control, type of institution, system price range, and major type of instrument: 1993

Institutional control, type of institution, system price range, and major type of instrument	Current age (percent of total systems)						Mean age (in years)
	Total	0 - 2 years	2 - 4 years	4 - 6 years	6 - 8 years	8+ years	
Total, all systems	100%	9%	15%	11%	15%	51%	7.9
Type of control:							
Public	100	6	19	7	17	51	8.2
Private.	100	12	9	17	12	50	7.5
Type of institution:							
Doctorate-granting	100	17	13	8	19	43	7.2
Non-doctorate-granting	100	5	15	13	13	54	8.2
System price range:							
$10,000-$19,999	100	6	19	13	14	49	7.7
$20,000 or more	100	13	8	10	16	53	8.0
Major type of instrument:							
Computers and data handling instruments	100	7	32	13	0	48	7.8
Chromatographs and spectrometers	100	21	12	21	4	42	6.3
Microscopy instruments	100	7	4	7	28	55	9.5
Bioanalytical instruments	100	3	20	13	16	48	7.8
Other instruments	100	6	15	4	17	58	8.0

NOTE: Because of rounding, percents may not add to 100.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

Instruments in private institutions were newer than those in public institutions. The mean age of instruments in private institutions was 7.5 years, versus 8.2 years in public institutions. Also, doctorate-granting institutions had slightly newer instruments than non-doctorate-granting institutions (7.2 years versus 8.2 years). Fifty-four percent of the instruments in non-doctorate-granting HBCUs were 8 years and older, versus 43 percent in the doctorate-granting institutions.

There was little difference in the average age of research instruments in the two price ranges. Instruments with a price range of $10,000–19,999 had an average age of 7.7 years; instruments with a purchase price of $20,000 and over had an average age of 8.0 years. The largest difference was among instruments aged 2–4 years; 19 percent of these were in the $10,000–19,999 price range, versus 8 percent in the higher price range.

Microscopy instruments had the oldest mean age (9.5 years) followed by "other" instruments (8 years) and bioanalytical and computers, each with a mean age of 7.8 years. The newest instruments were the chromatographs, with a mean age of 6.3 years. (Table 32)

5.3.4. Patterns of Use of Research Instruments in the Biological Sciences

Survey respondents were asked to provide the number (headcount) of investigators who made use of each piece of equipment for research purposes. The mean number of users per instrument was 9.3. (Table 33)

Table 33. Mean number of research users per system in the biological sciences at historically black colleges and universities, by major type of instrument and type of user: 1993

Major type of instrument	Mean number of research users per system					
	All users	Faculty of host department/ facility	Graduate students and postdoctorates from host department/ facility	Researchers from other departments/ facilities of host institution	Researchers outside the host institution	All other users
All instruments.....	9.3	2.8	2.9	0.9	0.1	2.7
Major type of instrument:						
Computers and data handling instruments.....	10.8	2.7	2.5	.4	.2	5.1
Chromatographs and spectrometers.....	7.3	2.4	3.2	.6	.2	1.0
Microscopy instruments.....	8.3	2.3	2.4	.7	.1	2.8
Bioanalytical instruments.....	13.0	3.8	3.7	1.2	.1	4.3
Other instruments.....	5.8	2.1	1.7	.9	-	1.1

KEY: - = less than 0.05 research users

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

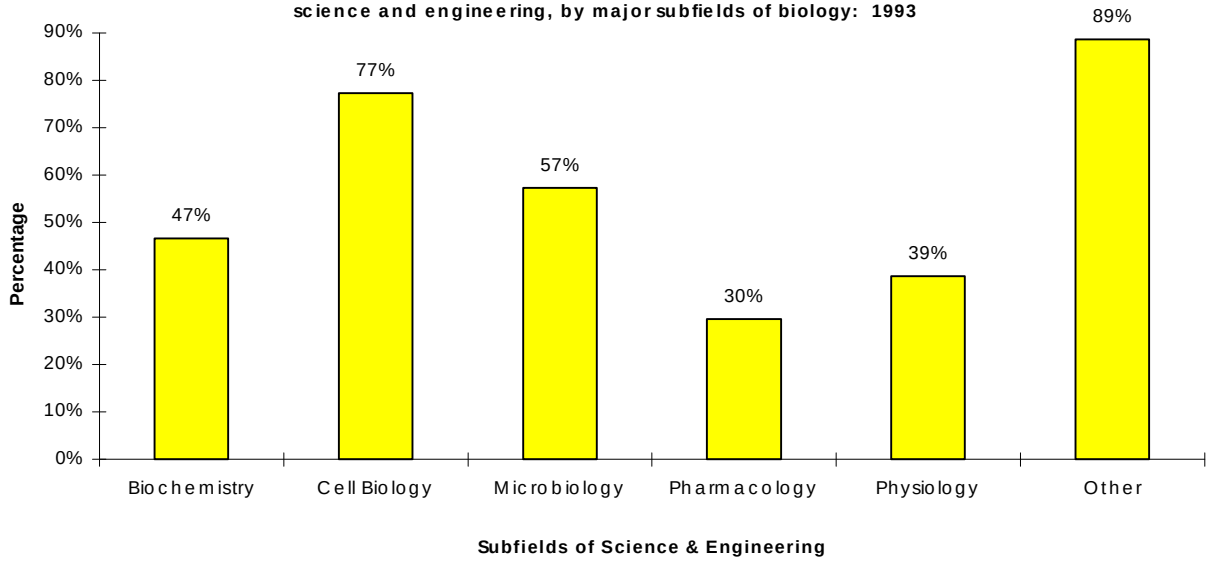
In 1993, most of the research users in the biological sciences were graduate students and postdoctorates from the host unit, an average of 2.9 users per instrument. The faculty of the host unit constituted the next largest group of users, with a mean of 2.8 users per instrument. All "other" users were the third largest group of instrument users, with a mean of 2.7 users per instrument. Researchers from other units of the host institution had an average of only 0.9 user per instrument. An even smaller average number of researchers from outside the host institution (0.1) used each instrument.

Among instrument types, the highest mean number of users per instrument was for bioanalytical instruments (13.0) followed by computers, which had a mean of 10.8 users per instrument. (Table 33) For both types of instruments, all "other" users had the highest number of users per instrument system.

Among user types, graduate students and postdoctorates from the host unit were the heaviest users of chromatographs (a mean of 3.2 users per instrument). The faculty of the host unit were the heaviest users of "other" instruments (a mean of 2.1 users per instrument).

Biological research instruments at HBCUs were not generally shared with researchers in other fields of science and engineering. In 1993, only 18 percent of these research instruments were used by an investigator outside of biology. The following analysis focuses upon three issues regarding these shared instruments. First, who shared their research instruments? That is, which of the major subfields within biology were most likely to share their research instruments with other major fields of science and engineering? Biological instruments were shared mostly in "other" fields of biology (89 percent), cell biology (79 percent), and microbiology (57 percent). (Figure 20)

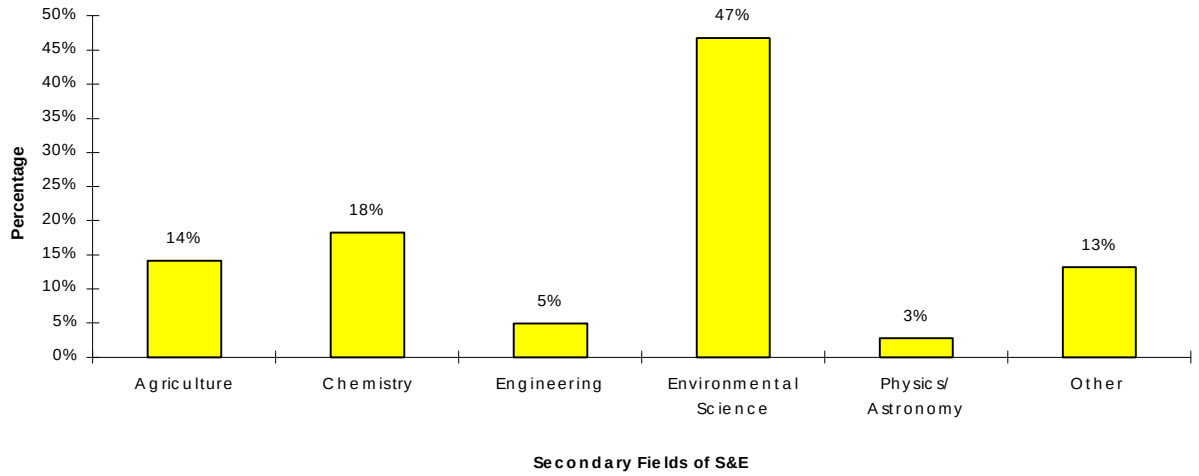
Figure 20. Percentage of biological instruments used for research in a secondary field of science and engineering, by major subfields of biology: 1993



Source: Academic Research Instruments and Instrumentation Needs in the Biological Sciences: 1994

Next, with which of the major fields of science and engineering were the research instruments in biology most likely to be shared? Research instruments in biology as a whole were most commonly used in environmental science—47 percent of the PIs in biology reported that their research instruments were used to conduct research or instruction in environmental science. (Figure 21)

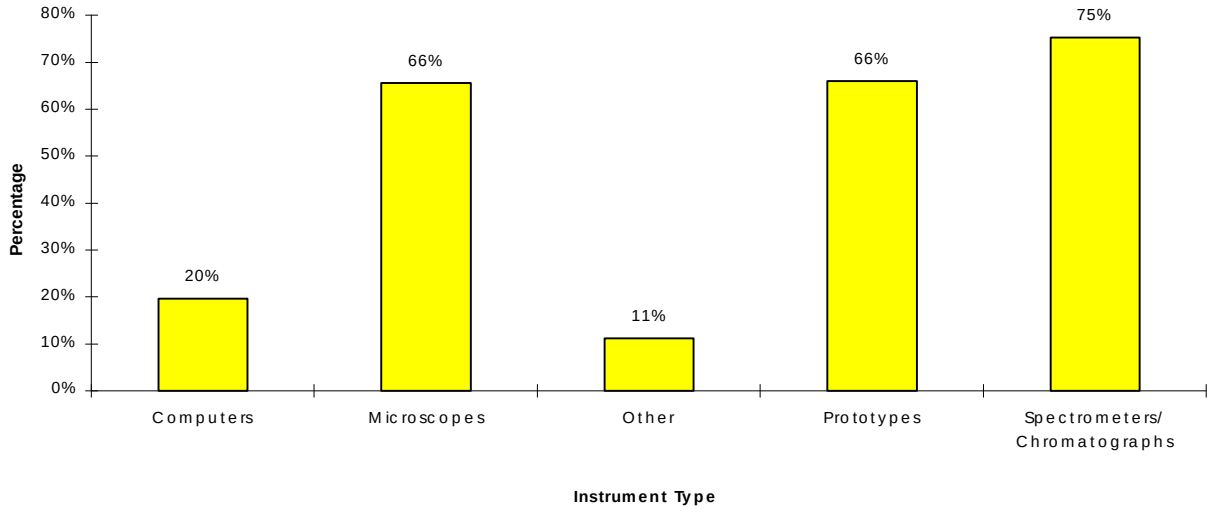
Figure 21. Percentage of biological instruments used for research in a secondary field of S&E, by secondary fields of S&E: 1993



Source: Academic Research Instruments and Instrumentation Needs in the Biological Sciences: 1994

Finally, what types of research instruments were most commonly shared? Microscopes, chromatographs, and major prototypes were the instruments most likely to be used by a researcher in a secondary field of S&E. As shown in Figure 22, 75 percent of the chromatographs and 66 percent of the microscopes and major prototypes used in biology were used for research in a secondary field of S&E.

Figure 22. Percentage of biological instruments used for research in a secondary field of S&E, by major types of instrument: 1993



Source: Academic Research Instruments and Instrumentation Needs in the Biological Sciences: 1994

5.4. Expenditures for the Purchase, Maintenance, and Repair of Research Instruments in the Biological Sciences at HBCUs

This section presents data on the aggregate cost of research instruments in the biological sciences at HBCUs and the 1993 expenditures to maintain and repair research instruments. The source of funds to purchase the instruments is also discussed.

5.4.1. Sources of Data

As noted previously, each participating institution was asked to provide an inventory of its biological science equipment, including the purchase price of each. A questionnaire was prepared for each instrument and forwarded to the PI responsible for the instrument. The PI then was asked to estimate both the source of funds that were used to purchase or acquire the instrument (including all of its dedicated accessories), and the expenditures made for maintenance/repair (but not operation) of the instrument and its accessories during FY 1993. Note that the funds to purchase this aggregate stock were expended in various years, not just the survey reference year.

5.4.2. Aggregate Stock of Research Instruments

The findings presented in this section refer to the total cost of the aggregate stock of research instruments in the biological sciences. This aggregate stock includes all research instruments with a purchase price of $10,000 or more that were being used to conduct biological research in the population of 44 HBCUs included in this survey. In 1993, this aggregate stock included 338 instruments that were used wholly or in part to conduct research in biology. (Table 31)

The estimates for the total cost of the aggregate stock of biological research instruments at HBCUs and the estimates for the sources of funds used to purchase that stock, should not be confused with those presented in the previous chapter of this report that provided data for current expenditures in departments and facilities at HBCUs. These findings were based upon data provided by unit-level respondents, rather than by the PIs responsible for the research instruments. The estimates made by the unit-level respondents for the total cost to purchase biological research instruments, and for the sources of the funds used to make these purchases, refer solely to those research instruments purchased in the survey reference year. The estimates made by the PI for the purchase of the aggregate stock of biological research instruments, and for the sources of funds used to purchase these instruments, refer to any research instrument in use during the survey reference year, regardless of its year of purchase.

5.4.3. Total Cost of Research Instruments in Use in 1993

The total cost of the aggregate stock of biological research instruments at the HBCUs in 1993 was $8.6 million. In terms of total cost, microscopy instruments were the largest category of

research instruments. The total cost of these instruments was $2.8 million, 33 percent of the total cost of all instruments. Bioanalytical instruments were the next largest category, with a total cost of $2.5 million, representing 29 percent of the total cost of instruments. Chromatographs were the third largest category, with a total aggregate cost of $1.4 million, 16 percent of the total cost of instruments. "Other" instruments, with a total aggregate cost of $1.2 million, and computers, with a total purchase price of $621 thousand, were the smallest categories in terms of total cost. (Table 34)

Table 34. Aggregate purchase price and percent distribution of academic research instruments in the biological sciences at historically black colleges and universities, by institutional control, type of institution, system price range, and major type of instrument: 1993

[Dollars in thousands]

Institutional control, type of institution, and system price range	Major type of instrument											
	All instruments		Computers and data handling instruments		Chromatographs and spectrometers		Microscopy instruments		Bioanalytical instruments		Other instruments	
	Total	Percent	Total	Percent	Total	Percent	Total	Percent	Total	Percent	Total	Percent
Total, all systems	$8,570	100%	$621	7%	$1,386	16%	$2,839	33%	$2,498	29%	$1,226	14%
Institutional control:												
Public.....	4,057	100	107	3	866	21	1,645	41	769	19	670	17
Private.....	4,512	100	514	11	520	12	1,193	26	1,728	38	556	12
Type of institution:												
Doctorate-granting....	4,179	100	484	12	647	15	878	21	1,439	34	731	17
Non-doctorate-granting.....	4,390	100	137	3	739	17	1,960	45	1,059	24	495	11
System price range:												
$10,000-$19,999.....	2,655	100	107	4	614	23	576	22	780	29	579	22
$20,000 or more	5,914	100	514	9	772	13	2,263	38	1,718	29	648	11

NOTE: Because of rounding, details may not add to totals.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

The median purchase price of a biological research instrument at the HBCUs in 1993 was $13,616.[37] Computers tended to be the most expensive type of research instrument located at the HBCUs. The median price of a computer was $22,135. Bioanalytical instruments were the next most expensive type of research instrument, with a median purchase price of $19,550.

Institutional Control. The aggregate purchase price for all instruments was slightly higher for private institutions ($4.5 million) than for public institutions ($4.1 million). (Table 34) Private institutions also had a larger total number of biological research instruments than did public institutions. (Table 31) The median purchase price for all instruments, however, presents a different perspective. The median purchase price of instruments for public institutions ($18,208) was higher than for private institutions ($16,500).

At public institutions, microscopy instruments constituted the largest proportion (41 percent) of the total aggregate cost of research instruments. The second largest proportion (21 percent) was for chromatographs. At private institutions, bioanalytical instruments constituted the largest proportion (38 percent) of the total aggregate cost, followed by microscopy instruments (26 percent). Additional details are found in Table 34.

Type of Institution. The aggregate purchase price for all instruments was slightly higher for non-doctorate-granting institutions ($4.4 million) than for doctorate-granting institutions ($4.2 million). (Table 34) The median purchase price for all instruments, however, was higher for doctorate-granting institutions ($20,000) than for non-doctorate-granting institutions ($14,575).

At doctorate-granting institutions, bioanalytical instruments constituted the largest proportion (34 percent) of the total aggregate cost of research instruments. The second largest proportion (21 percent of the total cost) was for microscopy instruments. At non-doctorate-granting institutions, microscopy instruments constituted the largest proportion of the total aggregate cost (45 percent) followed by bioanalytical instruments (24 percent). Additional details are found in Table 34.

5.4.4. Source of Funds for the Purchase of Research Instruments

The total Federal investment in the aggregate stock of biological science instruments at the HBCUs in 1993 was $5.8 million, or 67 percent of the total investment in these instruments. As shown in Table 35, a larger investment of the Federal funds was made to purchase instruments at these units in private institutions ($3.1 million) than these units at public institutions ($2.7 million). In addition, a slightly larger investment of Federal funds was made to purchase instruments at doctorate-granting institutions ($2.9 million) than at non-doctorate-granting institutions ($2.8 million). (Table 35)

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[37] Unpublished NIH instrumentation survey data

Table 35. Aggregate purchase price of academic research instruments in the biological sciences at historically black colleges and universities, by source of funds, institutional control, type of institution, and system price range: 1993

[Dollars in thousands]

Source of funds	Total, all systems	Type of control		Type of institution		System price range	
		Public	Private	Doctorate-granting	Non-doctorate-granting	$10,000-$19,999	$20,000 or more
Federal, total	$5,754	$2,679	$3,075	$2,948	$2,805	$2,135	$3,619
National Science Foundation	1,352	860	492	343	1,009	349	1,002
National Institutes of Health	3,048	1,350	1,698	2,048	1,000	1,303	1,745
Department of Defense	514	275	238	292	222	160	354
Department of Energy	128	89	38	0	128	89	38
Other Federal sources	712	104	608	266	447	234	479
Non-Federal, total	2,816	1,379	1,437	1,231	1,585	520	2,296
Institution funds	740	110	630	183	557	162	578
State grant or appropriation	1,089	1,089	0	710	379	141	948
Industry	186	149	37	37	149	75	111
Other non-Federal sources	802	31	771	301	500	143	659

NOTE: Because of rounding, details may not add to totals.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

NIH was the largest source of funds used to purchase the aggregate stock of biological research instruments at HBCUs—it provided $3.0 million, or 53 percent, of the total funds. NIH invested more funds in the aggregate stock of biological research instruments at private institutions ($1.7 million) than at public institutions ($1.4 million). It also invested more funds in the aggregate stock of research instruments at doctorate-granting institutions ($2.0 million) than at non-doctorate-granting institutions ($1.0 million).

Overall, non-Federal sources provided $2.8 million, or 33 percent, of all funds used to purchase the aggregate stock of biological research instruments at HBCUs. The largest amount of non-Federal funds was provided by State grants or appropriations—$1.1 million, or 13 percent, of the total funds. The second largest non-Federal source of funds was from "other" sources (i.e., private, nonprofit foundations, gifts, bonds). These provided $802 thousand, or 9 percent, of the total funds.

The major source of non-Federal funds to purchase the aggregate stock of biological research instruments in public institutions was from State grants or appropriations. For the private institutions, the majority of such funds to purchase the aggregate stock of biological research instruments were from "other" sources, followed closely by institution funds. (Table 35)

5.4.5. Cost of Maintenance and Repair of Research Instruments in the Biological Sciences

The annual expenditures to maintain and repair all instruments in 1993 were $358 thousand. This was 4.2 percent of the total cost of the aggregate stock of biological research instruments at the HBCUs that were in service in 1993. The most expensive category of research instrument to maintain/repair was microscopy, with a mean expenditure of $2,139 per instrument. The second most costly-to-maintain category was bioanalytical instruments, with a mean expenditure per instrument of $1,107. (Table 36)

Table 36. Total, mean, and median of annual expenditures for maintenance/repair (M/R) of academic research instruments in the biological sciences at historically black colleges and universities, and percent of aggregate purchase price, by major type of instrument: 1993

Major type of instrument	Annual expenditures for M/R	Mean (dollars)	Median (dollars)	Annual M/R as a percent of aggregate purchase price
All instruments	$358,117	$1,059	$0	4.2%
Major type of instrument:				
Computers and data handling instruments	17,453	888	0	2.8
Chromatographs and spectrometers	41,041	545	0	3.0
Microscopy instruments	140,326	2,139	0	4.9
Bioanalytical instruments	123,661	1,107	865	5.0
Other instruments	35,634	540	0	2.9

NOTE: Because of rounding, details may not add to totals.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

5.5. Status of Research Instruments in the Biological Sciences

The respondents were asked to assess the research status of the equipment in 1993 as: 1) state-of-the-art, the most highly developed and scientifically sophisticated equipment of its kind; or 2) not state-of-the-art, but adequate to meet the needs of the researchers in the department/facility; or 3) not state-of-the-art, inadequate to meet the needs of researchers in the department/facility.

Overall, the research status of the biological research instruments at HBCUs was rated as adequate in 1993. Sixty-one percent of the respondents rated their instruments as adequate to meet researchers' needs but not as state-of-the-art, while 32 percent rated them as state-of-the-art. Only 6 percent rated them as inadequate to meet researchers' needs. (Table 37)

5.5.1. Type of Control

Respondents at private institutions rated the research status of the equipment higher than did those from public institutions. Sixty-one percent of the respondents from private institutions rated their equipment as adequate to meet researchers' needs, 38 percent rated it as state-of-the-art, and

only 1 percent rated it as inadequate. At public institutions, 62 percent rated their instruments as adequate to meet researchers' needs, 26 percent rated them as state-of-the-art, and 12 percent rated them as inadequate. (Table 37)

Table 37. Percent distribution of academic research instruments in the biological sciences at historically black colleges and universities, by institutional control, type of institution, system price range, major type of instrument, and rated research status: 1993

[Percent of systems]

Institutional control, type of institution, system price range, and major type of instrument	Rated research status			
	All instruments	State-of-the- art	Adequate to meet researchers needs	Inadequate to meet researchers needs
Total, all systems	100%	32%	61%	6%
Type of control:				
Public	100	26	62	12
Private	100	38	61	1
Type of institution:				
Doctorate-granting	100	37	60	3
Non-doctorate-granting	100	28	62	9
System price range:				
$10,000-$19,999	100	31	64	5
$20,000 or more	100	35	57	8
Major type of instrument:				
Computers and data handling instruments	100	55	45	0
Chromatographs and spectrometers	100	30	56	13
Microscopy instruments	100	27	63	10
Bioanalytical instruments	100	33	66	2
Other instruments	100	33	63	4

NOTE: Because of rounding, percents may not add to 100.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

5.5.2. Type of Institution

Instruments at doctorate-granting institutions were rated slightly higher than those at non-doctorate-granting institutions. Sixty percent of the respondents at doctorate-granting institutions rated their instruments as adequate to meet researchers' needs, 37 percent as state-of-the-art, and only 3 percent as inadequate. At the non-doctorate-granting institutions, 62 percent rated their instruments as adequate, 28 percent as state-of-the-art, and 9 percent as inadequate. (Table 37)

5.5.3. Major Types of Instruments

Computers received the highest research status rating. Almost all computers used for research at the biology units in HBCUs had an original purchase price of less than $50,000. The respondents

rated them highly: 55 percent as state-of-the-art, 45 percent as adequate to meet researchers' needs, and none as inadequate. Bioanalytical instruments and "other" instruments received the second- and third-highest status ratings. Thirty-three percent of the respondents rated both categories of instruments as state-of-the-art. Sixty-six percent of the bioanalytical instruments were rated as adequate and only 2 percent were rated as inadequate. Sixty-three percent of the "other" instruments were rated as adequate and 4 percent as inadequate. (Table 37)

5.5.4. State-of-the-Art Instruments and Their Current Age

The state-of-the-art instruments comprised 32 percent of all instruments surveyed. In general, respondents reported fewer older instruments as state-of-the-art. Of all instruments less than 2 years of age, 70 percent were perceived to be state-of-the-art, while only 12 percent of the instruments 8 years and older were perceived as such. (Table 38)

Among major types of instruments, 55 percent of all computers were perceived to be state-of-the-art. All computers less than 6 years of age were perceived to be state-of-the-art, and none of the computers older than 6 years of age were perceived as such.

Table 38. Percent of instrument systems perceived as state-of-the-art for academic research in the biological sciences at historically black colleges and universities, by major type of instrument and current age of instrument: 1993

[Percent of systems]

Major type of instrument	Current age					
	Total	0 - 2 years	2 - 4 years	4 - 6 years	6 - 8 years	8+ years
All instruments	32%	70%	43%	37%	18%	12%
Major type of instrument:						
Computers and data handling instruments	55	100	100	100	0	0
Chromatographs and spectrometers	30	81	80	29	0	0
Microscopy instruments	27	36	100	0	9	15
Bioanalytical instruments	33	100	10	53	46	25
Other instruments	33	36	18	0	0	7

NOTES: The questionnaire was worded: "State-of-the-art: the most highly developed and scientifically sophisticated equipment of its kind."

The percents in this table are based on total responses per age group/instrument type

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

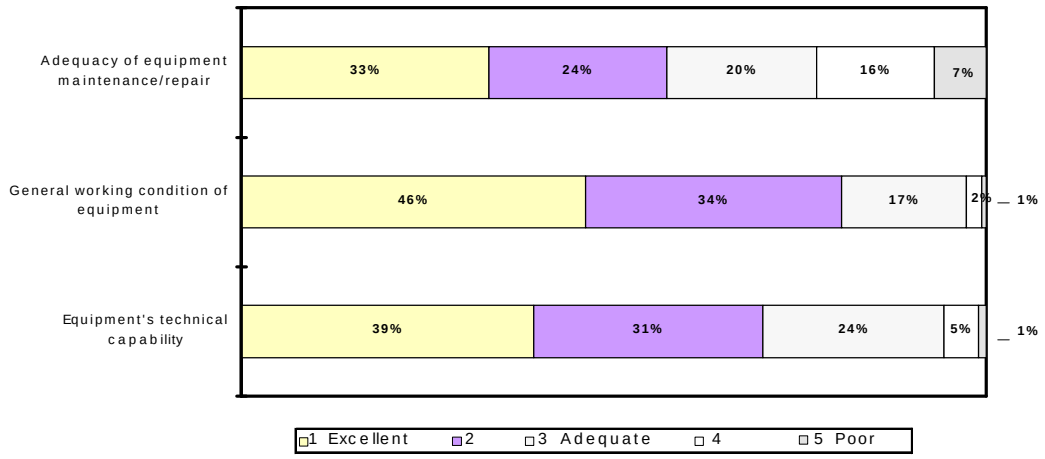
5.6. Adequacy of Research Instruments at HBCUs

The respondents were asked to rate the adequacy of their equipment's maintenance/repair, general working condition, and technical capabilities to meet the needs of the research users. The results from these questions are shown in Figure 23. It should be noted that 36 percent of the respondents reported that the maintenance/repair question was not applicable as their equipment

did not require servicing in 1993; the responses from these individuals are not reflected in the maintenance/repair bar on Figure 23.

The majority of respondents needing maintenance/repair services were satisfied with their adequacy: Seventy-seven percent of those respondents rated the maintenance/repair as adequate or above.

Figure 23. Adequacy of equipment maintenance/repair, general working condition, and technical capabilities (HBCU): 1994



Source: Academic Research Instrumentation & Instrumentation Needs in the Biological Sciences: 1994

The majority of the respondents (97 percent) rated the general working condition of their equipment as better than adequate. Thirty-nine of the respondents rated their equipment's technical capability to meet the needs of the research users as excellent, only 6 percent as less than adequate.